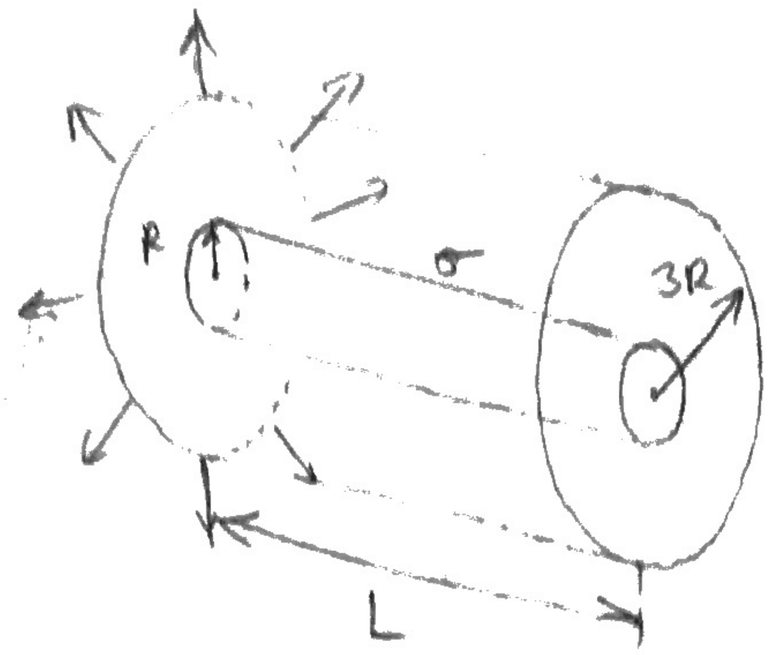
Pdt-pót ZH megoldásai

1.)



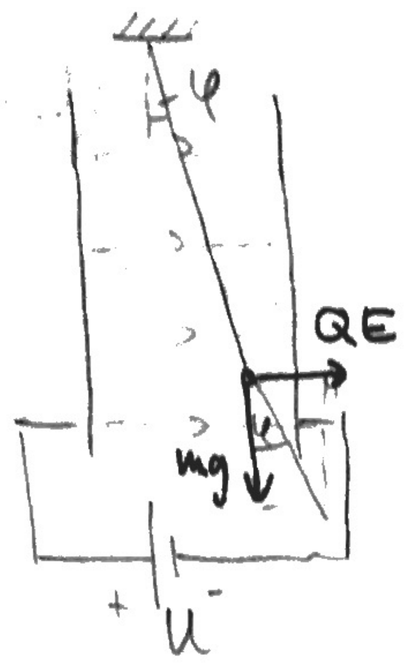
Gauss-törvény:

$$E(r)\, 2\pi r L = \frac{1}{\varepsilon_0} \cdot \underbrace{\sigma \cdot 2\pi R L}_{Q_{bezárt}}$$

$$E(r) = \frac{\sigma}{\varepsilon_0} \cdot \frac{R}{r}$$

$$E(r = 3R) = \frac{1}{3}\frac{\sigma}{\varepsilon_0} = 753\ \frac{V}{m}.$$ (B)

2.)



$$\tan\varphi = \frac{QE}{mg} = \frac{QU}{mgd}$$

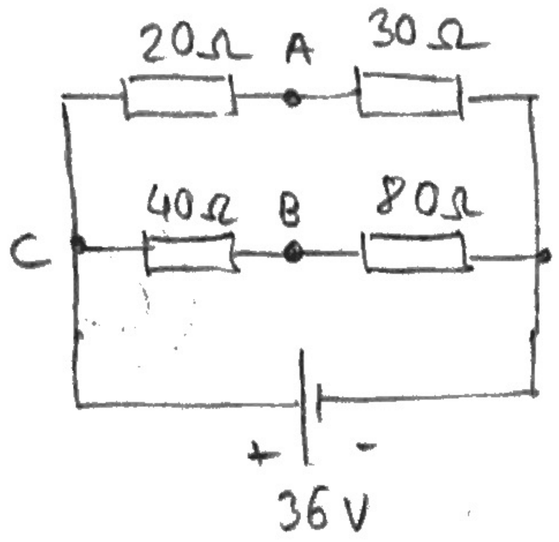
$$d = \frac{QU}{mg\tan\varphi} = \frac{20\cdot10^{-9}\cdot 15\cdot10^{3}}{6\,10^{-4}\cdot 9{,}8\cdot\tan 20^\circ} = 14{,}0\ cm$$ (A)

3.)

$$Q = \varepsilon_r C' \cdot U$$

$$U' = \frac{Q}{C'} = \varepsilon_r U = 2{,}5\cdot 12\,V = 30\,V.$$ (C)

4.)



$$U_{CA} = \frac{20\,\Omega}{20\,\Omega + 30\,\Omega}\cdot 36\,V = \frac{2}{5}\cdot 36\,V$$

$$U_{CB} = \frac{40\,\Omega}{40\,\Omega + 80\,\Omega}\cdot 36\,V = \frac{1}{3}\cdot 36\,V$$

$$U_{AB} = U_{CA} - U_{CB} = \left(\frac{2}{5} - \frac{1}{3}\right)\cdot 36\,V = 2{,}4\,V.$$ (A)

5.) A méréshatárt a műszeren áthaladó maximális áramerősség korlátozza:

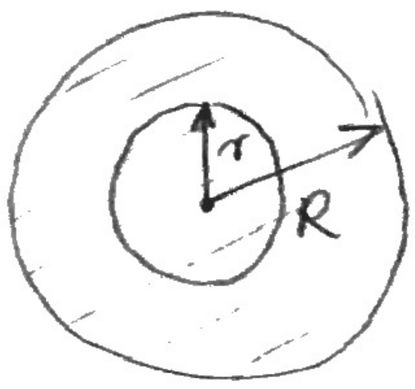
$$I_{max} = \frac{10\,V}{5\,k\Omega} = 2\cdot10^{-3}\,A.$$

A sorbakapcsolás után:

$$I_{max} = \frac{120\,V}{5k\Omega + R} \rightarrow R = \frac{1}{I_{max}}(120\,V - 10\,V) = \frac{1}{2}110\cdot10^{3} = 55\ k\Omega$$

(D)

6.)



Ampère-törvény:

$$2\pi r \cdot B = \mu_0 I_{átfolyó},$$

itt

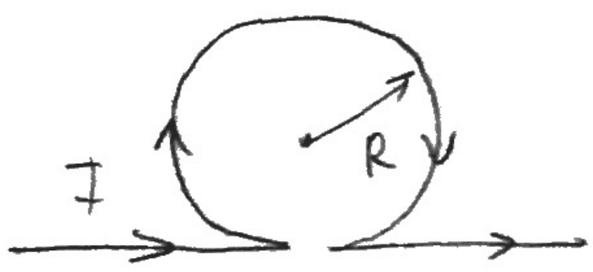
$$I_{átfolyó} = I \frac{\pi r^2}{\pi R^2} = I \frac{r^2}{R^2},$$

(A)

tehát:

$$B(r) = \frac{\mu_0 I}{2\pi} \frac{r}{R^2} = 2 \cdot 10^{-7} \cdot 2 \cdot \frac{0{,}02}{0{,}03^2} = 8{,}9\,\mu T.$$

7.)

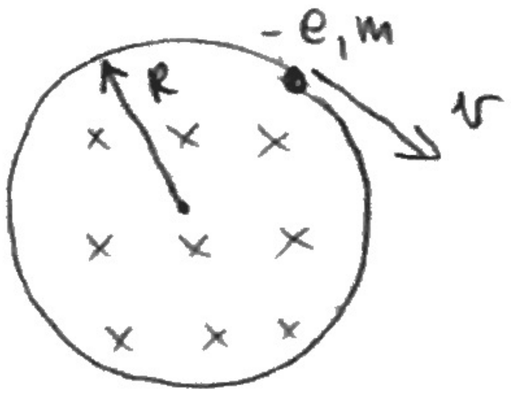


$$B_{kör} = \frac{\mu_0 I}{2R}, \quad B_{egyenes} = \frac{\mu_0 I}{2\pi R}$$

(C)

$$B_{eredő} = \frac{\mu_0 I}{2\pi R}(\pi - 1) = 2 \cdot 10^{-7} \frac{8}{0{,}06} \cdot 2{,}14 = 57{,}1\,\mu T$$

8.)



$$\frac{mv^2}{R} = evB \rightarrow R = \frac{mv}{eB} = \frac{p}{eB}$$

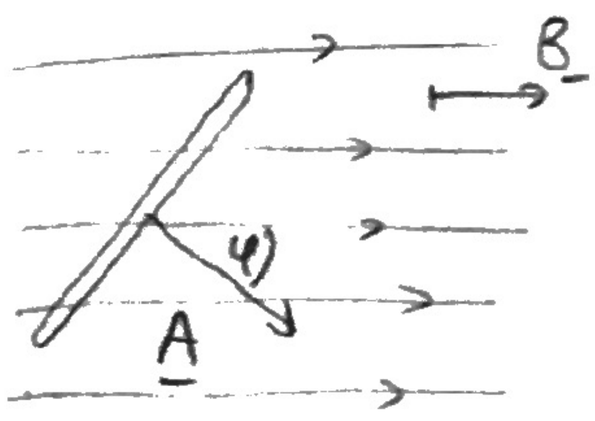
Az energia: $E = \frac{p^2}{2m} \rightarrow p = \sqrt{2mE}$

$$\Big\} \; R = \frac{\sqrt{2mE}}{eB}$$

$$E = 2 \cdot 1{,}6 \cdot 10^{-19}\,J$$

(B) $R = \underline{3{,}02\ cm}$

9.)



$$\Phi(t) = \underline{B}\,\underline{A}(t) = B\pi R^2 \cos \omega t$$

$$U_i = -\frac{d\Phi}{dt} = +B\pi R^2 \omega \sin(\omega t)$$

(C)

$$U_i(\varphi = 45°) = \frac{\sqrt{2}}{2} B\pi R^2 \omega = 0{,}0889\ V \approx 89\ mV$$

Igaz / Hamis:

1. H
2. H
3. I
4. I
5. I
6. H
7. H
8. I
9. I
10. H